THUMB-SIZED OPTICAL SPECTROMETER COULD BE A HANDY GADGET

Can You Imagine . . .

. . . a micro-optical spectrometer that will allow fiber-optics telecommunications systems to transmit higher data rates efficiently and affordably.

Successful implementation of high-speed fiber-optic data highways depends on the development of state-of-the-art optical devices at reasonable cost. Wavelength division multiplexing (WDM) systems, for example, can transmit multiple wavelength data channels on a single optical fiber. However, WDM systems require expensive technology to sort these wavelengths, spaced as close as 1.6 nanometers apart, for routing purposes.

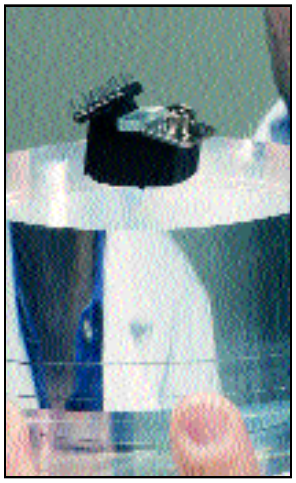
Oak Ridge National Laboratory (ORNL; Oak Ridge, TN) developed a thumb-sized optical spectrometer that offers an affordable solution for WDM and provides optical solutions for many other industries as well. The low-cost microspectrometer can sort light according to wavelengths, allowing fiber-optic telecommunications systems to route multiple data streams easily and efficiently. In a different configuration, the device can detect the presence of a variety of chemicals. These two capabilities open the door to many other applications, such as industrial process control, noninvasive blood chemistry analysis, and environmental and aircraft corrosion monitoring.

The microspectrometer is 6 cm^3 compared with today's television-sized laboratory spectrometers, which can be 20,000 cm^3. In addition, users can tune the rugged device for specific sensing applications. For example, when tuned as a gasoline octane analyzer, it could help alert motorists if any contaminated fuel enters the gas tank. Since it is fully aligned during fabrication (unlike conventional spectrometers), ORNL's device does not require periodic re-alignment. A novel fabrication technique of the microspectrometer lowers its cost. This technique uses specialized diamond-turning equipment originally developed for BMDO through ORNL's Manufacturing Operations Development and Integration Laboratory.

Sensiv, Inc., a manufacturer of infrared optical transmitter probes and remote process monitoring sensors, is the first company to receive a license for the microspectrometer. The company plans to use this technology in a second-generation product for monitoring chemical compositions during materials and pharmaceuticals manufacturing. Company officials project first-generation product availability in early 1997, and expect the microspectrometer's low cost to make the monitoring system more cost-competitive than other systems.

Lockheed Martin, ORNL's operator, now offers nonexclusive licenses in the near-infrared wavelength range of 0.7 to 5.0 microns. It may grant an exclusive license for a specialized application other than general process control and analysis.

SENSIV HAS ACQUIRED THE FIRST LICENSE FOR ORNL'S MICROSPECTROMETER.



■ The 6 cm^3 microspectrometer, pictured above, is much smaller than today's television-sized laboratory spectrometers, which can be 20,000 cm^3.

ABOUT THE TECHNOLOGY

The microspectrometer's design is a modified Czerny-Turner configuration that contains five precision surfaces encapsulated in a single structure. At the entrance surface, the optical fiber collects light and directs it to the collimating surface. The collimating surface redirects the light toward the grating surface. The grating surface disperses the incident light toward the focusing surface, which intercepts the diverging cone of light and focuses it onto the image surface. A detection array attached to the image surface interprets the light wavelengths.